# Herring Survey off Queen Charlotte Islands and Hecate Strait January 15-31, 1985 Cruise G.B.R. 85-1

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## ABSTRACT

McCarter, P. B. and D. E. Hay. 1985. Herring Survey Off Queen Charlotte Islands and Hecate Strait January 15-31, 1985. Can. Data Rep. Fish Aquat. Sci. 543: 39 p.

Hecate Strait and the Queen Charlotte Islands were surveyed in January, 1985 to identify and describe winter distributions of Pacific herring (Clupea harengus pallasi). Sounding records, midwater trawl and gillnet positions, catches and biological sampling data are presented. Significant quantities of herring were located in Juan Perez Sound. Herring aggregations were not detected in Browning Entrance although extensive areas were searched along northern mainland fishing grounds and inlets.

Key words: herring survey, Hecate Strait, trawl, gillnet

## RESUME

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En janvier 1985, on a réalisé des études dans le détroit d'Hécate et les îles Reine-Charlotte pour déterminer et décrire la répartition géographique des populations de hareng du Pacifique (Clupea harengus pallasi) en hiver. On présente les données relatives à l'échantillonnage biologique et aux prises, aux cahiers de sonde et à l'emplacement des filets maillants et des chaluts pélagiques. On a localisé d'importantes quantités de hareng dans la baie Juan Perez. On n'a pas trouvé de concentrations de hareng dans l'entrée Browning bien que l'on ait exploré de vastes secteurs le long des lieux de pêche et des bras de mer de la partie nord de la côte.

Mots-clés: étude sur le hareng, détroit d'Hécate, chalut, filet maillant

## INTRODUCTION

A G.B. REED cruise was conducted in January of 1985 to identify overwintering herring distributions in northern B.C. waters. This survey contributes to the Hecate Strait Project in which the overall objective is to map fish assemblages and develop an ecological basis for mixed-species assessment techniques.

## AREA OF SURVEY

Echo sounding was carried out at 9 knots using the G.B. REED's Simrad EK 38 sounder. Twenty-one hundred kilometers (1300 naut. mi.) of transect lines were logged covering eight major locations:

(1) S.E. coast of Moresby Island (Juan Perez Sound, Selwyn Inlet, Skincuttle Inlet and Laskeek Bay).
(2) Reef Island grounds to Horseshoe ground.
(3) North edge of Graham Island (Lanyara Island to Rose Spit).
(4) Rennell Sound and Hogback.
(5) Two Peaks - Butterworth Edge.
(6) Chatham Sound.
(7) Browning Entrance and Kitkatla Inlet.
(8) S.W. Bonilla Island.

Additional day and night soundings were also conducted en route between locations. Cruise tracks are shown in Figures 1 and 2 and sounding observations and data are recorded in Table 6. The number, intensity, depth, and size of fish schools encountered along each transect were recorded and subjectively identified as either herring or groundfish species. Off-bottom, dense showings, ascending or descending between 1400 hrs and 1100 hrs were usually identified as herring schools except in the Two Peaks vicinity where midwater pollock schools were suspected. Several other non-herring midwater schools were identified. In Juan Perez, midwater dogfish and pollock sound scattering layers were located beneath dense, white-lined herring schools. These layers remained in off-bottom positions (70-90 fm) in midafternoons while dense herring schools, immediately above, continued to ascend and skimmer out at 15-35 fathoms after twilight (Fig. 7-9). Seven tons of herring were trawled one evening at 35 fathoms from a 20 minute tow.

Bottom schools sounded in darkened hours (1800-0600 hrs) were usually identified as groundfish species while in midday hours (1100 - 1400 hrs) these schools were considered indistinguishable from herring bottom schools. In Juan Perez Sound, North Graham Island and Rennell Sound, transects were repeated day and night to assist species identification decisions. Most bottom schools surveyed were located on traditional, offshore groundfish trawling edges which have characteristic seasonal groundfish species compositions. Many inshore areas where herring may have been holding were not sounded or fished. A smaller fishing vessel equipped with sonar would be required to adequately survey these areas. Figure 3 shows distribution of sounded fish schools, fishing sets and trawling ground names.

## FISHING AND CATCHES

Four trawl tows using a Diamond 5 midwater trawl with 3 $m^2$ suberkrub doors were made during the cruise (Table 1). The first, in Juan Perez Sound yielded 7 tons of large herring and a few small dogfish. All other tows missed fish schools completely. The time required to set side trawl gear effectively limited catches to large and stationary midwater schools.

Eight gillnet sets were made near fish sounding areas. Seven were set along the S.E. coast of Moresby Island and one was set in Rennell Sound. No herring were captured but small pollock, blackcod, rockfish, sole, ratfish, and dogfish were gilled. Gillnet catches and sampling details are contained in Table 2. Gillnet setting arrangements are shown in Figure 4.

## SAMPLING RESULTS

Six hundred thirty eight trawl-caught herring from Juan Perez Sound were sampled fresh for length and sex (Table 3 and Figure 5). A sex ratio of 59:41 favored male fish. Herring stomachs were empty and gonads were classified as Hjort stage IV (Table 7).

Eight buckets of herring were frozen for shore processing. Fish weights and gonad weights were recorded from 100 females and 100 males. The gonosomatic index was 14.8 percent for females and 19.3 percent for males (Table 4a and 4b). Scales were removed from 100 herring and aged. Eight percent were age 3, twenty-six percent age 4, twelve percent age 5, one percent age 6, seventeen percent age 7, and thirty-six percent age 8. A strong 1977 year class (age 8) is still present in northern fish (Table 5 and Figure 6).

All twelve dogfish measured from the same Juan Perez tow were males between 32 and 89 cm in length. Four had been feeding on herring and the remainder had empty stomachs. Sampling details of gillnet catches are in Table 2.

Weather conditions were stable during the 17 day survey. Ocean temperatures at depth, determined by expendable bathythermographs (X.B.T.) varied from 6.0 to 8.5°C in Queen Charlotte Sound, 7.0 to 8.0°C in Hecate Strait, 6.5 to 8.0°C on the Hogback off the northwest coast of the Queen Charlotte Islands, and 7°C isothermal in Chatham Sound.

## ACKNOWLEDGMENTS

We thank Alf Fletcher, skipper of the G.B. REED and crew for assistance throughout the cruise. Age determinations were done by Margaret Burke.

Table 1. Summary of midwater trawl catches of the G.B. REED cruise 85-1, January 15-31, 1985.

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VESSEL: G.B. REED
LOCATION: Juan Perez Sound
START: Lat: 52 ° 33.01'
END: Lat: 52 ° 32.50'

Yr Mo Day
DATE: 85 01 22 SET/HAUL NO: 01
AREA: S.W. Ramsay Island
Long: 131 ° 30.00'
Long: 131 ° 28.17'

GEAR: Diamond 5 M.W. Trawl
BOTTOM DEPTH : Start: 270 m
NET DEPTH RANGE: 59 - 66 m

START TIME: (PST) : 2155 DURATION: 20 min
End: 221 m Est. Av. Depth.: 246 m
Est. Av. Depth.: 62 m

DIRECTION OF SET °true: 118
SET ON: Midwater school
WIND DIRECTION:

SPEED kn: 3.5 DISTANCE TRAVELLED 1.2 mi
WATER CONDITION: TIDE:
WIND SPEED: RECORDER: B. M.

TTM: TDM: BT: OTHER OCEANOGRAPHIC DATA

REMARKS: 75 fm warp. 7 tons of herring and some dogfish captured.
SOUNDER SUMMARY: Large school 20-40 fm. Fish dropped to 34-44 fm while towing. Net sounder not working properly.

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VESSEL: G.B. REED
LOCATION: West Porcher Island
START: Lat: 53 ° 52.28'
END: Lat: 53 ° 49.51

Yr Mo Day
DATE: 85 01 25 SET/HAUL NO: 02
AREA: North of Freeman's Ground
Long: 130 ° 56.61'
Long: 130 ° 54.43'

GEAR: Diamond 5 M.W. Trawl
BOTTOM DEPTH : Start: 90 m
NET DEPTH RANGE: 27 m

START TIME: (PST) : 1217 DURATION: 54 min
End: 93 m Est. Av. Depth.: 91 m
Est. Av. Depth.: 27 m

DIRECTION OF SET °true: 156
SET ON: Scattered schools
WIND DIRECTION: 300°

SPEED kn: 3.5 DISTANCE TRAVELLED 2.8 mi
WATER CONDITION: TIDE:
WIND SPEED: 10 RECORDER: B.M.

TTM: TDM: BT: OTHER OCEANOGRAPHIC DATA

REMARKS: 50 fm warp. Empty bag.
SOUNDER SUMMARY: Very light showing

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Table 1. (cont'd)

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VESSEL: G.B. REED — DATE: Yr 85 Mo 01 Day 26 — SET/HAUL NO: 03
LOCATION: Rennell Sound — AREA: East of Gospel Island
START: Lat: 53 ° 22.74' — Long: 132 ° 34.84'
END: Lat: 53 ° 22.91' — Long: 132 ° 34.84'

GEAR: Diamond 5 M.W. Trawl — START TIME: (PST) : 1026 — DURATION: 39 min
BOTTOM DEPTH : Start: 188 m — End: 113 m — Est. Av. Depth.: 119 m
NET DEPTH RANGE: 59-66 m — Est. Av. Depth.: 62 m

DIRECTION OF SET °true: 285° — SPEED kn: 3.5 — DISTANCE TRAVELLED: 2.0 mi
SET ON: Near bottom schools — WATER CONDITION: — TIDE:
WIND DIRECTION: 60° — WIND SPEED: 8 — RECORDER: B.M.
TTM: TDM: BT: — OTHER OCEANOGRAPHIC DATA
REMARKS: 75 fm warp. Empty bag.
SOUNDER SUMMARY: Missed school

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VESSEL: G.B. REED — DATE: Yr 85 Mo 01 Day 26 — SET/HAUL NO: 04
LOCATION: Off Rennell Sound — AREA: Hogback
START: Lat: 53 ° 18.80' — Long: 133 ° 02.30'
END: Lat: 53 ° 18.36' — Long: 133 ° 58.28'

GEAR: Diamond 5 M.W. Trawl — START TIME: (PST) : 1745 — DURATION: 35 min
BOTTOM DEPTH : Start: 214 m — End: 212 m — Est. Av. Depth.: 201 m
NET DEPTH RANGE: 165 m — Est. Av. Depth.: 165 m

DIRECTION OF SET °true: 110° — SPEED kn: 3.5 — DISTANCE TRAVELLED: 2.0 mi
SET ON: Near bottom schools — WATER CONDITION: — TIDE:
WIND DIRECTION: 210° — WIND SPEED: 19 — RECORDER: B.M.
TTM: TDM: BT: — OTHER OCEANOGRAPHIC DATA
REMARKS: 225 fm warp. Empty bag.
SOUNDER SUMMARY: Missed school. Trawl too far from bottom.

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Table 2. Summary of experimental gillnet catches of the G.B. REED cruise 85-1, January 15-31, 1985.

| Set number | Net type[a] | Location depth (m) | Date Time | Species caught | Length (cm) | Sex | Stomach contents |
|---|---|---|---|---|---|---|---|
| 1 | Pole (vertical) | Laskeek Bay 143 m | Jan. 20 0930-1100 | Nil | - | - | - |
| 2 | Lead-line (horizontal) | Laskeek Bay 143 m | Jan. 20 1030-1730 | Nil | - | - | - |
| 3 | Pole (vertical) | Beljay Bay 128 m | Jan. 20-21 1815-0800 | Nil | - | - | - |
| 4 | Pole (vertical) | Beljay Bay 155 m | Jan. 20-21 1900-0815 | pollock | 30 | 1 | empty |
| | | | | pollock | 36 | 2 | empty |
| 5 | Pole (vertical) | Darwin Sound 146 m | Jan. 21-22 1530-1000 | S. maliger | 35 | - | empty |
| | | | | dogfish | 84 | - | 20 cm sebastes, euphausiids |
| | | | | dogfish | 82 | - | 15 cm sebastes |
| | | | | dogfish | 76 | - | 23 cm herring , stage IV |
| | | | | dogfish | - | - | - |
| | | | | dogfish | - | - | - |
| 6 | Pole (vertical) | Darwin Sound 82 m | Jan. 21-22 1630-0930 | S. maliger | 30 | - | trace euphausiids |
| | | | | S. maliger | 37 | - | empty |
| | | | | S. maliger | 29 | - | empty |
| | | | | S. maliger (head only) | - | - | - |
| | | | | S. maliger (head only) | - | - | - |
| | | | | dogfish | 60 | - | empty |
| | | | | dogfish | - | - | - |
| 7 | Lead-line (horizontal) | Sedgwick Bay 114 m | Jan. 21-22 1800-1115 | blackcod | 25 | - | empty |
| | | | | blackcod | 37 | - | empty |
| | | | | dogfish | 80 | - | empty |
| | | | | dogfish | 63 | - | empty |
| 8 | Pole & lead line (horizontal) | Shields Bay 146 m | Jan. 26 1230-2100 | blackcod | 30 | - | empty |
| | | | | sand sole | 20 | - | empty |
| | | | | ratfish (head only) | - | - | - |
| | | | | dogfish | 70 | - | empty |

[a]see fig. 4

Table 3. Length frequency distribution of Juan Perez herring caught January 22, 1985.

| Length (mm) | Male frequency | Length (mm) | Male frequency | Length (mm) | Female frequency | Length (mm) | Female frequency |
|---|---|---|---|---|---|---|---|
| 180 | - | 230 | 15 | 180 | - | 230 | 9 |
| 1 | - | 1 | 15 | 1 | - | 1 | 9 |
| 2 | - | 2 | 14 | 2 | - | 2 | 6 |
| 3 | - | 3 | 5 | 3 | - | 3 | 2 |
| 4 | 1 | 4 | 9 | 4 | 1 | 4 | 12 |
| 5 | 1 | 5 | 7 | 5 | 1 | 5 | 9 |
| 6 | 1 | 6 | 2 | 6 | 1 | 6 | 3 |
| 7 | 0 | 7 | 5 | 7 | 0 | 7 | 6 |
| 8 | 3 | 8 | 6 | 8 | 0 | 8 | 5 |
| 9 | 1 | 9 | 3 | 9 | 1 | 9 | 11 |
| 190 | 0 | 240 | 3 | 190 | 0 | 240 | 6 |
| 1 | 1 | 1 | 2 | 1 | 0 | 1 | 9 |
| 2 | 2 | 2 | 1 | 2 | 1 | 2 | 8 |
| 3 | 0 | 3 | 4 | 3 | 0 | 3 | 1 |
| 4 | 0 | 4 | 0 | 4 | 0 | 4 | 2 |
| 5 | 3 | 5 | 2 | 5 | 0 | 5 | 1 |
| 6 | 3 | 6 | 0 | 6 | 4 | 6 | 2 |
| 7 | 5 | 7 | 0 | 7 | 1 | 7 | 2 |
| 8 | 6 | 8 | 0 | 8 | 0 | 8 | 0 |
| 9 | 4 | 9 | 0 | 9 | 2 | 9 | 3 |
| 200 | 7 | 250 | 0 | 200 | 2 | 250 | 2 |
| 1 | 2 | 1 | 0 | 1 | 4 | 1 | 3 |
| 2 | 7 | 2 | 0 | 2 | 1 | 2 | 0 |
| 3 | 7 | 3 | 0 | 3 | 1 | 3 | 0 |
| 4 | 5 | 4 | 0 | 4 | 5 | 4 | 1 |
| 5 | 14 | 5 | 0 | 5 | 3 | 5 | 0 |
| 6 | 6 | 6 | 1 | 6 | 2 | 6 | 2 |
| 7 | 14 | 7 | 0 | 7 | 0 | 7 | 1 |
| 8 | 7 | 8 | 0 | 8 | 2 | 8 | - |
| 9 | 2 | 9 | 0 | 9 | 5 | 9 | - |
| 210 | 9 | 260 | 0 | 210 | 5 | 260 | - |
| 1 | 8 | 1 | 0 | 1 | 6 | 1 | - |
| 2 | 11 | 2 | 1 | 2 | 6 | 2 | - |
| 3 | 5 | 3 | - | 3 | 0 | 3 | - |
| 4 | 9 | 4 | - | 4 | 6 | 4 | - |
| 5 | 7 | 5 | - | 5 | 5 | 5 | - |
| 6 | 6 | 6 | - | 6 | 7 | 6 | - |
| 7 | 12 | 7 | - | 7 | 6 | 7 | - |
| 8 | 12 | 8 | - | 8 | 4 | 8 | - |
| 9 | 12 | 9 | - | 9 | 6 | 9 | - |
| 200 | 9 | 270 | - | 220 | 10 | 270 | - |
| 1 | 8 | | | 1 | 14 | | |
| 2 | 17 | | | 2 | 2 | | |
| 3 | 4 | Total | 377 | 3 | 7 | Total | 261 |
| 4 | 5 | | | 4 | 2 | | |
| 5 | 8 | | | 5 | 6 | | |
| 6 | 4 | | | 6 | 8 | | |
| 7 | 15 | | | 7 | 1 | | |
| 8 | 6 | | | 8 | 4 | | |
| 9 | 13 | | | 9 | 5 | | |

Table 4a. Gonosomatic index of Juan Perez herring caught January 22, 1985. Females only.

| Fish no. | Fish weight (g) | Ovary weight (g) | G.S.I. (%) | Fish no. | Fish weight (g) | Ovary weight (g) | G.S.I. (%) | Fish no. | Fish weight (g) | Ovary weight (g) | G.S.I. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 214 | 34.2 | 16.0 | 34 | 200 | 24.0 | 12.0 | 67 | 130 | 16.6 | 12.8 |
| 2 | 185 | 37.4 | 20.2 | 35 | 155 | 14.6 | 9.4 | 68 | 168 | 31.2 | 18.6 |
| 3 | 133 | 17.6 | 13.2 | 36 | 144 | 23.0 | 16.0 | 69 | 178 | 25.6 | 14.3 |
| 4 | 145 | 21.2 | 14.6 | 37 | 215 | 43.2 | 20.1 | 70 | 130 | 20.2 | 15.5 |
| 5 | 176 | 29.0 | 16.5 | 38 | 109 | 16.0 | 14.7 | 71 | 148 | 17.6 | 11.9 |
| 6 | 205 | 47.0 | 22.9 | 39 | 150 | 25.0 | 16.7 | 72 | 152 | 18.8 | 12.4 |
| 7 | 203 | 39.0 | 19.2 | 40 | 165 | 29.0 | 17.6 | 73 | 125 | 15.8 | 12.6 |
| 8 | 144 | 24.2 | 16.8 | 41 | 148 | 18.4 | 12.4 | 74 | 144 | 16.8 | 11.7 |
| 9 | 156 | 14.2 | 9.1 | 42 | 46 | 23.2 | 15.9 | 75 | 123 | 12.4 | 10.1 |
| 10 | 213 | 35.6 | 16.7 | 43 | 199 | 18.2 | 9.2 | 76 | 189 | 30.8 | 16.3 |
| 11 | 218 | 36.2 | 16.6 | 44 | 200 | 33.6 | 16.8 | 77 | 133 | 21.2 | 15.9 |
| 12 | 182 | 26.4 | 14.5 | 45 | 171 | 29.0 | 17.0 | 78 | 95 | 7.2 | 7.6 |
| 13 | 208 | 33.0 | 15.9 | 46 | 200 | 31.8 | 15.4 | 79 | 155 | 25.2 | 16.3 |
| 14 | 213 | 25.4 | 11.9 | 47 | 211 | 34.4 | 16.3 | 80 | 163 | 20.4 | 12.5 |
| 15 | 152 | 25.2 | 16.6 | 48 | 165 | 16.0 | 9.7 | 81 | 105 | 9.6 | 9.1 |
| 16 | 213 | 32.8 | 15.4 | 49 | 155 | 29.2 | 18.8 | 82 | 145 | 20.4 | 14.1 |
| 17 | 201 | 33.6 | 16.7 | 50 | 144 | 27.0 | 18.8 | 83 | 122 | 14.4 | 11.8 |
| 18 | 185 | 32.6 | 17.6 | 51 | 157 | 24.6 | 15.7 | 84 | 202 | 25.0 | 12.4 |
| 19 | 141 | 11.6 | 8.2 | 52 | 163 | 23.0 | 14.1 | 85 | 167 | 30.8 | 18.4 |
| 20 | 187 | 21.6 | 11.6 | 53 | 117 | 18.2 | 15.6 | 86 | 165 | 18.6 | 11.3 |
| 21 | 178 | 19.4 | 10.9 | 54 | 147 | 27.6 | 18.8 | 87 | 153 | 22.0 | 14.4 |
| 22 | 157 | 23.8 | 15.2 | 55 | 159 | 22.0 | 13.8 | 88 | 179 | 33.4 | 18.7 |
| 23 | 168 | 26.2 | 15.6 | 56 | 212 | 36.8 | 17.4 | 89 | 147 | 17.4 | 11.8 |
| 24 | 174 | 33.0 | 19.0 | 57 | 166 | 27.8 | 16.8 | 90 | 147 | 20.6 | 14.0 |
| 25 | 198 | 27.8 | 14.0 | 58 | 160 | 17.4 | 10.9 | 91 | 197 | 42.0 | 21.3 |
| 26 | 119 | 15.4 | 12.9 | 59 | 183 | 36.6 | 20.0 | 92 | 138 | 13.8 | 10.0 |
| 27 | 159 | 20.2 | 12.7 | 60 | 204 | 19.8 | 9.7 | 93 | 165 | 31.8 | 19.3 |
| 28 | 151 | 27.4 | 18.2 | 61 | 186 | 31.2 | 16.8 | 94 | 197 | 23.6 | 11.9 |
| 29 | 181 | 22.2 | 12.3 | 62 | 104 | 9.0 | 8.6 | 95 | 170 | 34.4 | 20.2 |
| 30 | 105 | 11.2 | 10.7 | 63 | 138 | 29.6 | 21.4 | 96 | 172 | 30.2 | 17.6 |
| 31 | 182 | 28.8 | 15.8 | 64 | 185 | 25.6 | 13.8 | 97 | 189 | 29.0 | 15.3 |
| 32 | 149 | 18.2 | 12.2 | 65 | 177 | 25.6 | 14.5 | 98 | 109 | 11.8 | 10.8 |
| 33 | 175 | 21.2 | 12.1 | 66 | 182 | 25.0 | 13.7 | 99 | 221 | 445.6 | 20.6 |
| | | | | | | | | 100 | 167 | 25.4 | 15.2 |

Mean fish weight: 166 g. Mean ovary weight: 24.9 g. G.S.I.: 14.8%

Table 4b. Gonosomatic index of Juan Perez herring caught January 22, 1985. Males only.

| Fish no. | Fish weight (g) | Testes weight (g) | G.S.I. (%) | Fish no. | Fish weight (g) | Testes weight (g) | G.S.I. (%) | Fish no. | Fish weight (g) | Testes weight (g) | G.S.I. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 186 | 37.6 | 20.2 | 34 | 23 | 18.8 | 15.3 | 67 | 99 | 15.8 | 16.0 |
| 2 | 160 | 30.0 | 18.8 | 35 | 175 | 35.4 | 20.2 | 68 | 114 | 13.6 | 11.9 |
| 3 | 201 | 37.6 | 18.7 | 36 | 121 | 23.8 | 19.7 | 69 | 141 | 225.2 | 17.9 |
| 4 | 150 | 26.4 | 17.6 | 37 | 148 | 32.4 | 21.9 | 70 | 122 | 22.6 | 18.5 |
| 5 | 168 | 37.0 | 22.0 | 38 | 152 | 32.4 | 21.3 | 71 | 156 | 31.2 | 20.0 |
| 6 | 138 | 25.4 | 18.4 | 39 | 93 | 17.8 | 19.1 | 72 | 133 | 27.4 | 20.6 |
| 7 | 95 | 16.4 | 17.2 | 40 | 131 | 25.6 | 19.5 | 73 | 155 | 30.0 | 19.4 |
| 8 | 177 | 38.0 | 21.4 | 41 | 24 | 24.2 | 19.5 | 74 | 119 | 23.4 | 19.7 |
| 9 | 193 | 22.0 | 22.8 | 42 | 186 | 33.6 | 18.1 | 75 | 100 | 17.4 | 17.4 |
| 10 | 128 | 21.2 | 16.5 | 43 | 181 | 36.6 | 20.2 | 76 | 178 | 35.2 | 19.8 |
| 11 | 159 | 31.8 | 20.0 | 44 | 165 | 28.8 | 17.5 | 77 | 153 | 31.6 | 20.7 |
| 12 | 182 | 32.2 | 17.7 | 45 | 167 | 32.8 | 19.6 | 78 | 101 | 16.6 | 16.4 |
| 13 | 161 | 32.8 | 20.4 | 46 | 151 | 29.2 | 19.3 | 79 | 129 | 24.8 | 19.2 |
| 14 | 135 | 24.2 | 17.9 | 47 | 192 | 41.0 | 21.4 | 80 | 141 | 26.0 | 18.4 |
| 15 | 104 | 19.0 | 18.3 | 48 | 19 | 42.2 | 21.2 | 81 | 162 | 26.0 | 16.0 |
| 16 | 137 | 26.0 | 19.0 | 49 | 127 | 28.4 | 22.4 | 82 | 182 | 36.2 | 20.0 |
| 17 | 188 | 37.2 | 19.8 | 50 | 166 | 34.8 | 21.0 | 83 | 173 | 36.2 | 20.9 |
| 18 | 225 | 51.6 | 22.9 | 51 | 159 | 28.4 | 17.9 | 84 | 152 | 30.0 | 19.7 |
| 19 | 194 | 39.8 | 20.5 | 52 | 156 | 18.4 | 11.8 | 85 | 214 | 45.2 | 21.1 |
| 20 | 156 | 30.2 | 19.4 | 53 | 164 | 38.0 | 23.2 | 86 | 94 | 19.6 | 20.9 |
| 21 | 227 | 41.0 | 18.1 | 54 | 158 | 29.4 | 18.6 | 87 | 103 | 19.2 | 18.6 |
| 22 | 136 | 24.6 | 18.1 | 55 | 143 | 23.0 | 16.1 | 88 | 128 | 25.4 | 19.8 |
| 23 | 222 | 42.2 | 19.0 | 56 | 165 | 30.0 | 18.2 | 89 | 157 | 28.8 | 18.3 |
| 24 | 152 | 32.0 | 21.1 | 57 | 172 | 33.8 | 19.7 | 90 | 108 | 20.8 | 19.3 |
| 25 | 114 | 20.2 | 17.7 | 58 | 137 | 28.4 | 20.7 | 91 | 114 | 19.8 | 17.4 |
| 26 | 143 | 28.6 | 20.0 | 59 | 184 | 39.8 | 21.6 | 92 | 128 | 25.8 | 20.2 |
| 27 | 169 | 33.2 | 19.7 | 60 | 196 | 37.2 | 19.0 | 93 | 154 | 32.0 | 20.8 |
| 28 | 181 | 41.4 | 22.9 | 61 | 191 | 33.0 | 17.3 | 94 | 160 | 28.0 | 17.5 |
| 29 | 194 | 35.2 | 18.1 | 62 | 190 | 37.2 | 19.6 | 95 | 147 | 26.8 | 18.2 |
| 30 | 178 | 36.6 | 20.6 | 63 | 148 | 28.2 | 19.1 | 96 | 135 | 22.6 | 16.7 |
| 31 | 174 | 36.8 | 21.1 | 64 | 191 | 41.6 | 21.8 | 97 | 112 | 21.0 | 18.8 |
| 32 | 178 | 38.4 | 21.6 | 65 | 105 | 19.0 | 18.1 | 98 | 169 | 34.0 | 20.1 |
| 33 | 143 | 25.4 | 17.8 | 66 | 133 | 25.4 | 19.1 | 99 | 131 | 28.2 | 21.5 |
| | | | 1074 | | | 1008.6 | | 100 | 129 | 25.8 | 20.0 |

Mean fish weight: 153 g. Mean testes weight: 29.7 g. G.S.I.: 19.3%

Table 5. Age composition sample of herring caught in Juan Perez Sound, January 22, 1985 (00 indicates fish unable to be aged).

| Age (years) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ | Not aged | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of herring | 0 | 0 | 0 | 7 | 22 | 10 | 1 | 15 | 31 | 0 | 0 | 14 | 100 |
| Percent Composition | - | - | - | 8 | 26 | 12 | 1 | 17 | 36 | - | - | - | 100 |

| Fish no. | Fish length (mm) | Fish weight (g) | Sex | Mat | Age | Gonad weight (g) | Fish no. | Fish length (mm) | Fish weight (g) | Sex | Mat | Age | Gonad weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 236 | 239 | 1 | 5 | 8 | 53 | 26 | 214 | 131 | 1 | 5 | 3 | 22 |
| 2 | 212 | 146 | 2 | 4 | 5 | 15 | 27 | 210 | 139 | 1 | 5 | 4 | 24 |
| 3 | 233 | 211 | 2 | 4 | 8 | 36 | 28 | 203 | 121 | 2 | 4 | 5 | 19 |
| 4 | 232 | 208 | 2 | 4 | 7 | 43 | 29 | 215 | 164 | 1 | 5 | 8 | 30 |
| 5 | 192 | 096 | 1 | 5 | 3 | 14 | 30 | 214 | 137 | 1 | 5 | 8 | 26 |
| 6 | 206 | 123 | 2 | 4 | 4 | 11 | 31 | 222 | 165 | 1 | 4 | 8 | 34 |
| 7 | 203 | 118 | 2 | 4 | 3 | 16 | 32 | 222 | 164 | 1 | 5 | 8 | 35 |
| 8 | 205 | 127 | 1 | 5 | 3 | 26 | 33 | 225 | 159 | 1 | 4 | 7 | 27 |
| 9 | 233 | 191 | 2 | 4 | 4 | 25 | 34 | 225 | 164 | 2 | 4 | 5 | 13 |
| 10 | 206 | 144 | 2 | 4 | 00 | 24 | 35 | 230 | 193 | 2 | 4 | 7 | 37 |
| 11 | 236 | 210 | 2 | 4 | 8 | 41 | 36 | 226 | 151 | 2 | 3 | 5 | 09 |
| 12 | 233 | 205 | 2 | 4 | 8 | 38 | 37 | 237 | 211 | 1 | 4 | 8 | 48 |
| 13 | 223 | 184 | 2 | 4 | 8 | 30 | 38 | 223 | 156 | 2 | 4 | 4 | 19 |
| 14 | 228 | 184 | 1 | 5 | 7 | 36 | 39 | 251 | 231 | 2 | 4 | 00 | 46 |
| 15 | 227 | 201 | 2 | 4 | 8 | 40 | 40 | 210 | 142 | 2 | 3 | 7 | 13 |
| 16 | 215 | 167 | 2 | 4 | 4 | 33 | 41 | 193 | 120 | 1 | 5 | 00 | 24 |
| 17 | 223 | 160 | 1 | 4 | 7 | 30 | 42 | 245 | 204 | 2 | 4 | 00 | 35 |
| 18 | 228 | 201 | 2 | 4 | 8 | 42 | 43 | 233 | 203 | 2 | 4 | 8 | 45 |
| 19 | 230 | 183 | 2 | 4 | 8 | 29 | 44 | 220 | 159 | 1 | 4 | 7 | 31 |
| 20 | 221 | 171 | 1 | 5 | 4 | 30 | 45 | 222 | 158 | 1 | 5 | 8 | 27 |
| 21 | 220 | 169 | 1 | 5 | 7 | 36 | 46 | 216 | 124 | 2 | 4 | 00 | 35 |
| 22 | 225 | 166 | 2 | 4 | 8 | 28 | 47 | 224 | 152 | 1 | 4 | 00 | 28 |
| 23 | 207 | 130 | 2 | 4 | 00 | 27 | 48 | 193 | 096 | 1 | 5 | 3 | 17 |
| 24 | 230 | 202 | 1 | 4 | 8 | 45 | 49 | 215 | 143 | 1 | 4 | 00 | 21 |
| 25 | 207 | 127 | 1 | 5 | 4 | 26 | 50 | 250 | 203 | 1 | 5 | 8 | 40 |

Table 5 (cont'd)

| Fish no. | Fish length (mm) | Fish weight (g) | Sex | Mat | Age | Gonad weight (g) | Fish no. | Fish length (mm) | Fish weight (g) | Sex | Mat | Age | Gonad weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 217 | 165 | 1 | 5 | 5 | 39 | 76 | 195 | 102 | 2 | 4 | 4 | 09 |
| 52 | 210 | 119 | 2 | 4 | 4 | 12 | 77 | 213 | 130 | 1 | 5 | 7 | 22 |
| 53 | 197 | 124 | 2 | 4 | 00 | 13 | 78 | 208 | 130 | 1 | 4 | 4 | 27 |
| 54 | 231 | 188 | 2 | 4 | 7 | 27 | 79 | 197 | 091 | 1 | 4 | 3 | 14 |
| 55 | 221 | 180 | 1 | 4 | 7 | 38 | 80 | 214 | 138 | 1 | 5 | 4 | 24 |
| 56 | 230 | 166 | 1 | 4 | 7 | 31 | 81 | 213 | 153 | 1 | 5 | 7 | 32 |
| 57 | 222 | 160 | 2 | 4 | 4 | 21 | 82 | 207 | 143 | 1 | 7 | 4 | 24 |
| 58 | 231 | 197 | 2 | 4 | 8 | 37 | 83 | 245 | 235 | 2 | 4 | 8 | 32 |
| 59 | 200 | 118 | 2 | 4 | 4 | 22 | 84 | 216 | 158 | 1 | 4 | 6 | 31 |
| 60 | 205 | 133 | 2 | 4 | 00 | 16 | 85 | 235 | 183 | 1 | 4 | 8 | 36 |
| 61 | 213 | 144 | 1 | 4 | 5 | 26 | 86 | 211 | 160 | 2 | 4 | 00 | 23 |
| 62 | 213 | 163 | 2 | 4 | 4 | 30 | 87 | 232 | 194 | 2 | 4 | 8 | 29 |
| 63 | 233 | 171 | 2 | 4 | 8 | 27 | 88 | 216 | 154 | 1 | 5 | 5 | 29 |
| 64 | 215 | 152 | 1 | 5 | 7 | 30 | 89 | 188 | 099 | 1 | 4 | 3 | 18 |
| 65 | 228 | 198 | 1 | 5 | 8 | 31 | 90 | 196 | 113 | 1 | 5 | 4 | 26 |
| 66 | 206 | 127 | 2 | 4 | 4 | 17 | 91 | 211 | 149 | 1 | 5 | 5 | 23 |
| 67 | 195 | 112 | 1 | 4 | 5 | 16 | 92 | 227 | 191 | 2 | 4 | 8 | 23 |
| 68 | 219 | 145 | 1 | 4 | 00 | 28 | 93 | 197 | 111 | 1 | 5 | 4 | 21 |
| 69 | 225 | 146 | 2 | 4 | 7 | 15 | 94 | 204 | 126 | 2 | 4 | 4 | 18 |
| 70 | 226 | 175 | 2 | 4 | 8 | 30 | 95 | 220 | 166 | 2 | 3 | 8 | 15 |
| 71 | 222 | 163 | 2 | 4 | 8 | 20 | 96 | 222 | 170 | 1 | 4 | 8 | 33 |
| 72 | 220 | 158 | 2 | 4 | 4 | 20 | 97 | 216 | 189 | 1 | 4 | 5 | 29 |
| 73 | 221 | 151 | 1 | 4 | 00 | 24 | 98 | 201 | 114 | 1 | 5 | 4 | 21 |
| 74 | 210 | 138 | 2 | 4 | 00 | 18 | 99 | 211 | 141 | 1 | 5 | 8 | 29 |
| 75 | 220 | 168 | 1 | 4 | 8 | 31 | 100 | 207 | 132 | 2 | 4 | 4 | 14 |

Table 6. Sounding log of G.B. REED cruise 85-1 Jan. 15-31, 1985.

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| Burnaby is. to Horseshoe (50 fm edge) | 17/01/85 | | | | | | | | |
| A1 | 1630-1757 | 13.0 | 87 | 9.0 | Several - light | 91-101 | 101 | 1.2 | Groundfish |
| A2 | 1757-1816 | 3.0 | 19 | 9.5 | None - | - | - | - | - |
| A3 | 1816-2000 | 12.4 | 97 | 7.7 | One - heavy | 64-101 | 91-110 | 0.5 | Groundfish |
| A4 | 2000-2008 | 1.0 | 8 | 7.5 | None - | - | - | - | - |
| A5 | 2008-2032 | 3.0 | 25 | 7.2 | One - medium | 128-137 | 137 | 0.4 | Groundfish |
| A6 | 2032-2041 | 1.8 | 10 | 10.8 | None - | - | - | - | - |
| A7 | 2041-2111 | 4.8 | 30 | 9.6 | One - medium | 73-91 | 91 | 0.3 | Groundfish |
| A8 | 2111-2125 | 2.0 | 13 | 9.2 | None - | - | - | - | - |
| A9 | 2125-2242 | 16.0 | 117 | 8.2 | Two - medium | 82-101 | 101 | 1.4 | Groundfish |
| A10 | 2242-2259 | 2.3 | 17 | 8.1 | None - | - | - | - | - |
| | 18/01/85 | | | | | | | | |
| A11 | 2259-0327 | 32.8 | 226 | 8.7 | Three - medium | 82-101 | 101 | 0.6 | Groundfish |
| A12 | 0327-0343 | 2.1 | 15 | 8.4 | None - | - | - | - | - |
| A13 | 0343-0720 | 32.8 | 217 | 9.1 | One - light | 79-88 | 88 | 0.2 | Groundfish |
| A14 | 0720-0735 | 2.4 | 15 | 9.6 | None - | - | - | - | - |
| A15 | 0735-1153 | 40.8 | 255 | 9.6 | One - heavy | 73-110 | 140 | 0.2 | Herring |
| A16 | 1153-1207 | 2.3 | 15 | 9.2 | None - | - | - | - | - |
| Horseshoe to Bonilla is. (50 fm edge) | | | | | | | | | |
| A17 | 1207-1243 | 4.5 | 34 | 7.9 | None - | - | - | - | - |
| A18 | 1243-1301 | 2.4 | 18 | 8.0 | None - | - | - | - | - |
| A19 | 1301-1336 | 4.1 | 35 | 7.1 | None - | - | - | - | - |
| A20 | 1336-1350 | 2.2 | 13 | 10.1 | None - | - | - | - | - |
| A21 | 1350-1423 | 4.0 | 35 | 6.9 | None - | - | - | - | - |
| A22 | 1423-1443 | 2.4 | 18 | 8.0 | None - | - | - | - | - |
| A23 | 1443-1520 | 6.0 | 39 | 9.2 | None - | - | - | - | - |
| A24 | 1520-1535 | 2.2 | 17 | 7.8 | None - | - | - | - | - |
| A25 | 1535-1610 | 5.0 | 30 | 10.0 | None - | - | - | - | - |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| A26 | 1610-1625 | 2.3 | 14 | 9.9 | None - | - | - | - | - |
| A27 | 1625-1655 | 4.3 | 32 | 8.1 | None - | - | - | - | - |
| A28 | 1655-1725 | 2.2 | 16 | 8.3 | None - | - | - | - | - |
| A29 | 1725-1812 | 4.4 | 47 | 5.6 | None - | - | - | - | - |
| A30 | 1812-1858 | 6.8 | 46 | 8.9 | None - | - | - | - | - |
| A31 | 1858-1954 | 7.4 | 54 | 8.2 | None - | - | - | - | - |
| A32 | 1954-2100 | 8.5 | 65 | 7.9 | One - heavy | 81-99 | 101 | 0.1 | Groundfish |
| Laskeek Bay | 19/01/85 | | | | | | | | |
| A33 | 1211-1238 | 4.0 | 27 | 8.9 | None - | - | - | - | - |
| A34 | 1238-1315 | 5.5 | 35 | 9.4 | None - | - | - | - | - |
| A35 | 1315-1324 | 1.5 | 9 | 10.0 | Several - heavy | 104-146 | 146 | 0.7 | Groundfish |
| Laskeek Bay | 20/01/85 | | | | | | | | |
| A35 | 0635-0651 | 1.5 | 11 | 8.2 | One - heavy | 119-137 | 137-146 | 0.5 | Groundfish |
| A34 | 0651-0738 | 5.5 | 36 | 9.2 | Several - light | 101-119 | 119-128 | 1.2 | Groundfish |
| A36 | 0738- set | 6.2 | 39 | 9.5 | One - medium | 121-146 | 134-146 | 0.8 | Groundfish |
| A37 | 1144-1210 | 6.5 | 36 | 10.8 | None - | - | - | - | - |
| Outside Reef Is. | | | | | | | | | |
| A38 | 1210-1245 | 3.1 | 21 | 8.9 | None - | - | - | - | - |
| A39 | 1245-1314 | 4.8 | 29 | 9.9 | None - | - | - | - | - |
| A40 | 1314-1330 | 2.4 | 16 | 9.0 | None - | - | - | - | - |
| A41 | 1330-1430 | 9.8 | 62 | 9.5 | None - | - | - | - | - |
| Selwyn Inlet | | | | | | | | | |
| A42 | 1535-1550 | 3.0 | 16 | 11.3 | None - | - | - | - | - |
| A43 | 1550-1564 | 1.8 | 11 | 9.8 | None - | - | - | - | - |
| A44 | 1564-1620 | 3.0 | 17 | 10.6 | Several - medium to heavy | 128-156 | 150-168 | 1.8 | Herring |
| A44 | 1620-1637 | 3.0 | 16 | 11.3 | Several - medium to heavy | 128-156 | 150-168 | 1.9 | Herring |
| A43 | 1637-1647 | 1.8 | 10 | 10.8 | None - | - | - | - | - |
| A42 | 1647-1703 | 3.0 | 16 | 11.3 | One - medium | 183-210 | 210 | 0.4 | Groundfish |
| Outside Lyell Is. | 21/01/85 | | | | | | | | |
| A45 | 0919-1037 | 10.4 | 79 | 7.9 | None - | - | - | - | - |
| A46 | 1037-1113 | 6.0 | 34 | 10.6 | None - | - | - | - | - |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| A47 | 1113-1129 | 2.4 | 15 | 9.6 | None - | - | - | - | - |
| A48 | 1129-1205 | 5.8 | 35 | 9.9 | None - | - | - | - | - |
| A49 | 1205-1214 | 1.0 | 7 | 8.6 | None - | - | - | - | - |
| A50 | 1214-1247 | 5.8 | 34 | 10.2 | None - | - | - | - | - |
| A51 | 1247-1306 | 2.0 | 20 | 6.0 | None - | - | - | - | - |
| Juan Perez Snd. | | | | | | | | | |
| A52 | 1306-1341 | 6.5 | 36 | 10.8 | One - medium | 192-201 | 210 | 0.2 | Groundfish |
| A53 | 1341-1454 | 10.0 | 70 | 8.6 | Several - heavy | 137-156 | 156-220 | 2.6 | Herring and groundfish |
| A54 | 1634-1710 | 5.5 | 35 | 9.4 | Two - heavy | 134-152 | 220 | 0.6 | Herring and groundfish |
| A55 | 1710-1743 | 3.5 | 32 | 6.6 | One - heavy | 119-146 | 165 | 0.1 | Herring |
| | | | | | One - light | 119-146 | 165 | 1.1 | Groundfish |
| A56 | 1800-1900 | 9.0 | 57 | 9.5 | Two - heavy | 57-75 | 128 | 1.0 | Herring |
| | | | | | | 33-59 | 201 | 1.1 | Herring |
| Juan Perez Snd. | 22/01/85 | | | | | | | | |
| A53 | 0830-0922 | 8.2 | 56 | 8.8 | Two - heavy | 119-137 | 146-192 | 0.4 | Herring and groundfish |
| A54 | 1006-1043 | 6.5 | 37 | 10.5 | One - heavy | 128-165 | 165-220 | 0.5 | Herring and groundfish |
| A55 | 1043-1115 | 3.5 | 32 | 6.6 | Several - heavy | 115-170 | 137-183 | 2.0 | Herring and groundfish |
| Burnaby Is. | | | | | | | | | |
| A4-A7 | 1500-1800 | 11.0 | (Repeated) | | None - | - | - | - | - |
| Juan Perez Snd. | | | | | | | | | |
| A56 | 1914-2015 | 10.0 | 63 | 9.5 | One - heavy | 22-64 | 210 | 2.1 | Herring (verified by 7 ton catch) |
| Juan Perez Snd. | 23/01/85 | | | | | | | | |
| A52 | 0924-1012 | 7.0 | 49 | 8.6 | Three - heavy | 137-174 | 183-238 | 0.6 | Herring |
| A57 | 1012-1326 | 29.0 | 191 | 9.1 | None - | - | - | - | - |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| Skincuttle Inlet | | | | | | | | | |
| A58 | 1326-1342 | 1.8 | 16 | 6.8 | None - | - | - | - | - |
| A59 | 1342-1353 | 1.9 | 12 | 9.5 | None - | - | - | - | - |
| A60 | 1353-1415 | 3.0 | 22 | 8.2 | None - | - | - | - | - |
| Cape St. James | | | | | | | | | |
| A61 | 1415-1806 | 35.0 | 231 | 9.1 | None - | - | - | - | - |
| Browning Entrance | 24/01/85 | | | | | | | | |
| B1 | 0605-0753 | 17.5 | 108 | 9.7 | None - | - | - | - | - |
| B2 | 0753-0922 | 10.0 | 98 | 6.1 | None - | - | - | - | - |
| B3 | 0922-1018 | 7.0 | 56 | 7.5 | None - | - | - | - | - |
| Kitkatla Inlet | | | | | | | | | |
| B4 | 1018-1106 | 7.3 | 50 | 8.8 | None - | - | - | - | - |
| B5 | 1106-1115 | 1.0 | 9 | 6.7 | None - | - | - | - | - |
| B6 | 1115-1123 | 1.5 | 8 | 11.3 | None - | - | - | - | - |
| B7 | 1123-1135 | 2.2 | 12 | 11.0 | None - | - | - | - | - |
| B8 | 1135-1200 | 3.0 | 24 | 7.5 | None - | - | - | - | - |
| B9 | 1200-1220 | 2.7 | 25 | 7.0 | None - | - | - | - | - |
| B9 | 1220-1248 | 2.7 | 25 | 6.5 | None - | - | - | - | - |
| B8 | 1248-1313 | 3.0 | 25 | 7.2 | None - | - | - | - | - |
| B7 | 1313-1328 | 2.2 | 14 | 9.4 | None - | - | - | - | - |
| B6 | 1328-1337 | 1.5 | 10 | 9.0 | None - | - | - | - | - |
| B5 | 1337-1345 | 1.0 | 6 | 10.0 | Several - light | 18-55 | 73-101 | 1.2 | Herring |
| B4 | 1345-1426 | 7.3 | 41 | 10.7 | None - | - | - | - | - |
| Browning Entrance | | | | | | | | | |
| B10 | 1426-1503 | - | 35 | - | None - | - | - | - | - |
| Browning Entrance | 25/01/85 | | | | | | | | |
| B11 | 0850-0940 | 8.1 | 49 | 9.9 | One - light | 64-82 | 82 | 0.3 | Groundfish |
| B12 | 0940-1003 | 5.4 | 30 | 10.8 | Several - medium | 27-55 | 91 | 0.4 | Herring |
| B13 | 1003-1038 | 4.9 | 35 | 8.4 | Several - medium | 27-55 | 91 | 0.1 | Herring |
| Rose Spit to Langara Is. | | | | | | | | | |
| C1 | 1649-1721 | 6.3 | 37 | 10.2 | Several - light | 55-73 | 101 | 0.3 | Herring |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| C2 | 1721-1805 | 7.4 | 45 | 9.9 | Several - light | 55-73 | 101 | 0.2 | Herring |
| C3 | 1805-1823 | 3.0 | 18 | 10.0 | None - | - | - | - | - |
| C4 | 1823-1840 | 2.9 | 17 | 10.2 | One - light | 70-73 | 82 | 0.9 | Groundfish |
| C5 | 1840-1916 | 5.6 | 35 | 9.6 | One - light | 70-82 | 82 | 0.8 | Groundfish |
| C6 | 1916-1944 | 4.0 | 26 | 9.2 | One - light | 55-73 | 73 | 0.3 | Groundfish |
| C7 | 1944-2002 | 2.8 | 18 | 9.3 | None - | - | - | - | - |
| C8 | 2002-2025 | 3.9 | 23 | 10.2 | None - | - | - | - | - |
| C9 | 2025-2039 | 2.4 | 14 | 10.3 | None - | - | - | - | - |
| C10 | 2039-2108 | 4.5 | 28 | 9.6 | None - | - | - | - | - |
| C11 | 2108-2133 | 3.9 | 25 | 9.4 | None - | - | - | - | - |
| C12 | 2133-2150 | 3.1 | 20 | 9.3 | None - | - | - | - | - |
| C13 | 2150-2237 | 7.0 | 44 | 9.6 | None - | - | - | - | - |
| C14 | 2237-2258 | 3.3 | 20 | 9.9 | None - | - | - | - | - |
| C15 | 2258-2328 | 4.9 | 30 | 9.8 | None - | - | - | - | - |
| C16 | 2328-2400 | 4.7 | 29 | 9.7 | Several - light | 110-128 | 146-183 | 1.1 | Herring |
| Langara Is. to Rennell Sound | 26/01/85 | | | | | | | | |
| C17 | 2400-0028 | 4.0 | 30 | 8.0 | Several - light | 128-146 | 174-238 | 1.9 | Herring |
| C18 | 0028-0239 | 18.2 | 130 | 8.4 | Several - light | 73-82 | 82 | 0.3 | Groundfish |
| C19 | 0239-0310 | 4.9 | 31 | 9.5 | None - | - | - | - | - |
| C20 | 0310-0343 | 5.4 | 33 | 9.8 | None - | - | - | - | - |
| C21 | 0343-0415 | 4.4 | 32 | 8.3 | None - | - | - | - | - |
| C22 | 0415-0433 | 3.1 | 18 | 10.3 | None - | - | - | - | - |
| C23 | 0433-0525 | 8.0 | 53 | 9.1 | None - | - | - | - | - |
| C24 | 0525-0707 | 16.7 | 102 | 9.8 | Several - light | 146-165 | 220 | 1.6 | Herring |
| C25 | 0707-0810 | 8.0 | 61 | 7.9 | Several - light | 146-165 | 220 | 1.6 | Herring |
| Rennell Sound | | | | | | | | | |
| C26 | 0810-0857 | 7.0 | 43 | 9.7 | Several - medium | 64-119 | 82-128 | 0.3 | Groundfish |
| C27 | 0857-0925 | 5.0 | 28 | 10.7 | None - | - | - | - | - |
| C28 | 0925-0945 | 4.5 | 20 | 13.0 | One - heavy | 55-119 | 119 | 0.2 | Herring |
| C29 | 1149-1204 | 2.0 | 15 | 8.0 | Several - medium | 146-165 | 165 | 0.9 | Herring |
| C30 | 1204-1230 | 2.5 | 21 | 7.1 | Several - medium | 146-165 | 165 | 1.2 | Herring |

Table 6 (cont'd)

| Location<br>Transect name | Date<br>Time | Length<br>M | Duration<br>(min) | Speed<br>(knts) | Number & intensity of fish schools | Depth of fish<br>(m) | Depth of bottom<br>(m) | Length of fish schools<br>M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| C31 | 1305-1358 | 7.0 | 51 | 8.2 | None - | - | - | - | - |
| 'Hogback' Bank | | | | | | | | | |
| C32 | 1358-1524 | 12.2 | 83 | 8.8 | One - heavy | 73-165 | 146-183 | 0.7 | Sebastes sp. (ocean perch) |
| C33 | 1524-1542 | 2.0 | 16 | 7.5 | One - heavy | 165-183 | 183 | 1.5 | Sebastes sp. (ocean perch) |
| C34 | 1542-1551 | 1.5 | 10 | 9.0 | One - heavy | 91-192 | 192 | 0.9 | Sebastes sp. (ocean perch) |
| C35 | 1551-1606 | 2.0 | 15 | 8.0 | One - heavy | 146-192 | 192 | 1.9 | Sebastes sp. (ocean perch) |
| C36 | 1606-1620 | 2.0 | 14 | 8.6 | One - heavy | 165-192 | 192-201 | 2.0 | Sebastes sp. (ocean perch) |
| Langara Is. | 27/01/85 | | | | | | | | |
| D0 | 0705-0850 | 13.0 | 89 | 8.8 | Several - light | 110-146 | 119-146 | 0.4 | Groundfish and herring |
| D1 | 0850-0934 | 6.7 | 43 | 9.3 | One - heavy | 70-106 | 106 | 0.2 | Herring |
| D2 | 0934-0951 | 2.4 | 17 | 8.5 | None - | - | - | - | - |
| D3 | 0951-1010 | 3.1 | 22 | 8.5 | None - | - | - | - | - |
| D4 | 1010-1057 | 6.6 | 44 | 9.0 | None - | - | - | - | - |
| D5 | 1057-1137 | 5.8 | 41 | 8.5 | None - | - | - | - | - |
| D6 | 1137-1222 | 6.7 | 44 | 9.1 | None - | - | - | - | - |
| D7 | 1222-1405 | 16.8 | 101 | 10.0 | None - | - | - | - | - |
| McIntyre Bay | | | | | | | | | |
| D8 | 1405-1447 | 6.5 | 44 | 8.9 | None - | - | - | - | - |
| D9 | 1447-1522 | 5.0 | 32 | 9.4 | None - | - | - | - | - |
| D10 | 1522-1554 | 5.0 | 32 | 9.4 | Several - light | 9-27 | 91-101 | 0.8 | Herring |
| D11 | 1554-1629 | 4.8 | 34 | 8.5 | None - | - | - | - | - |
| D12 | 1629-1653 | 3.8 | 24 | 9.5 | None - | - | - | - | - |
| D13 | 1653-1714 | 3.1 | 21 | 8.9 | - | - | - | - | - |
| D14 | 1714-1740 | 3.5 | 24 | 8.8 | None - | - | - | - | - |
| D15 | 1740-1810 | 4.6 | 33 | 8.4 | Several - light | 91-128 | 119-137 | 1.4 | Pollock and groundfish |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| Rose Spit | | | | | | | | | |
| D16 | 1810-2040 | 20.0 | 148 | 8.1 | Several - light | 64-101 | 91-119 | 2.2 | Pollock and groundfish |
| Two Peaks | | | | | | | | | |
| D17 | 2040-2108 | 5.2 | 27 | 11.6 | Several - light | 82-101 | 110 | 0.4 | Pollock and groundfish |
| D18 | 2108-2200 | 6.8 | 51 | 8.0 | Several - light | 82-91 | 110 | 0.3 | Pollock and groundfish |
| Butterworth Edge | | | | | | | | | |
| D19 | 2200-2226 | 4.1 | 27 | 9.1 | None - | - | - | - | - |
| D20 | 2226-2254 | 4.1 | 28 | 8.8 | Several - light | 82-101 | 91-101 | 0.7 | Groundfish |
| D21 | 2254-2332 | 6.0 | 38 | 9.5 | None - | - | - | - | - |
| D22 | 2332-0020 28/01/85 | 7.6 | 49 | 9.3 | One - light | 91-110 | 110 | 1.9 | Groundfish |
| D23 | 0020-0220 | 15.2 | 122 | 7.5 | One - medium | 55-91 | 73-91 | 8.8 | Groundfish |
| D24 | 0220-0238 | 3.1 | 15 | 12.4 | Several - light | 101-110 | 128 | 0.4 | Groundfish |
| D25 | 0238-0325 | 7.0 | 47 | 8.9 | None - | - | - | - | - |
| Dundas Is. | | | | | | | | | |
| D26 | 0325-0545 | 19.7 | 138 | 8.6 | Several - light | 110-128 | 146 | 2.0 | Groundfish |
| D27 | 0545-0620 | 5.4 | 37 | 8.8 | None - | - | - | - | - |
| D28 | 0620-0645 | 3.1 | 23 | 8.1 | None - | - | - | - | - |
| Chatham Snd. | | | | | | | | | |
| E1 | 0645-0715 | 4.1 | 30 | 8.2 | None - | - | - | - | - |
| E2 | 0715-0732 | 2.9 | 18 | 9.7 | None - | - | - | - | - |
| E3 | 0732-0750 | 1.9 | 16 | 7.1 | None - | - | - | - | - |
| E4 | 0750-0820 | 4.8 | 30 | 9.6 | One - light | 82-91 | 0 | 1.3 | Groundfish |
| E5 | 0820-0840 | 3.0 | 20 | 9.0 | None - | - | - | - | - |
| E6 | 0840-0907 | 4.3 | 28 | 9.2 | One - light | 82-91 | 143 | 0.3 | Herring |
| E7 | 0907-0923 | 2.0 | 16 | 7.5 | None - | - | - | - | - |
| E8 | 0923-0925 | 1.4 | 11 | 7.6 | None - | - | - | - | - |
| E9 | 0925-1014 | 6.8 | 41 | 9.9 | None - | - | - | - | - |
| E10 | 1014-1051 | 5.4 | 37 | 8.8 | None - | - | - | - | - |

Table 6 (cont'd)

| Location Transect name | Date Time | Length M | Duration (min) | Speed (knts) | Number & intensity of fish schools | Depth of fish (m) | Depth of bottom (m) | Length of fish schools M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| E11 | 1051-1129 | 2.5 | 37 | 4.1 | None - | - | - | - | - |
| E12 | 1129-1150 | 3.8 | 21 | 10.8 | None - | - | - | - | - |
| E13 | 1150-1205 | 2.8 | 15 | 11.2 | None - | - | - | - | - |
| E14 | 1205-1232 | 4.4 | 26 | 10.1 | Several - light | 128-137 | 128-146 | 0.3 | Groundfish |
| E15 | 1232-1247 | 2.2 | 14 | 9.4 | None - | - | - | - | - |
| E16 | 1247-1316 | 4.6 | 28 | 9.9 | Several - light | 128-146 | 165-174 | 0.8 | Groundfish |
| E17 | 1316-1331 | 2.3 | 15 | 9.2 | None - | - | - | - | - |
| E18 | 1331-1416 | 7.6 | 45 | 10.1 | Several - light | 110-128 | 128 | 0.8 | Groundfish |
| E19 | 1416-1437 | 3.6 | 21 | 10.3 | Several - light | 128-146 | 174 | 0.5 | Groundfish |
| E20 | 1437-1515 | 11.2 | 66 | 10.2 | None - | - | - | - | - |
| E21 | 1515-1613 | 4.4 | 26 | 10.2 | None - | - | - | - | - |
| E22 | 1613-1644 | 4.3 | 32 | 8.1 | None - | - | - | - | - |
| E23 | 1644-1740 | 8.7 | 56 | 9.3 | One - heavy | 101-110 | 110 | 0.6 | Groundfish |
| E24 | 1740-1812 | 4.7 | 32 | 8.8 | None - | - | - | - | - |
| E25 | 1812-1832 | 2.9 | 20 | 8.7 | None - | - | - | - | - |
| E26 | 1832-1906 | 6.0 | 36 | 10.0 | One - medium | 82-101 | 91-101 | 0.3 | Groundfish |
| Browning Entrance | | | | | | | | | |
| F1 | 2124-2210 | 6.4 | 39 | 9.8 | None - | - | - | - | - |
| F2 | 2210-2238 | 4.5 | 34 | 7.9 | None - | - | - | - | - |
| F3 | 2238-0000 | 7.0 | 47 | 8.9 | None - | - | - | - | - |
| Browning Entrance | 29/01/85 | | | | | | | | |
| F4 | 0000-0054 | 7.4 | 48 | 9.3 | None - | - | - | - | - |
| F5 | 0054-0140 | 8.5 | 47 | 10.8 | None - | - | - | - | - |
| F6 | 0140-0226 | 8.0 | 46 | 10.4 | None - | - | - | - | - |
| F7 | 0226-0318 | 8.3 | 50 | 9.9 | None - | - | - | - | - |
| F8 | 0318-0408 | 8.1 | 50 | 9.7 | None - | - | - | - | - |
| F9 | 0408-0503 | (Sounder malfunction) | | | | | | | |
| F10 | 0503-0600 | 9.4 | 56 | 10.1 | None - | - | - | - | - |
| F11 | 0600-0700 | 9.0 | 62 | 8.7 | Several - light | 110-128 | 128 | 1.2 | Groundfish |
| F12 | 0700-0814 | 9.2 | 73 | 7.6 | Several - light | 119-128 | 137 | 0.5 | Groundfish |
| F13 | 0814-0935 | 10.7 | 80 | 8.0 | None - | - | - | - | - |
| F14 | 0935-1103 | 11.8 | 86 | 8.2 | None - | - | - | - | - |

Table 6 (cont'd)

| Location<br>Transect name | Date<br>Time | Length<br>M | Duration<br>(min) | Speed<br>(knts) | Number & intensity of fish schools | Depth of fish<br>(m) | Depth of bottom<br>(m) | Length of fish schools<br>M | Probable species |
|---|---|---|---|---|---|---|---|---|---|
| F15 | 1103-1220 | 11.2 | 78 | 8.6 | None - | - | - | - | - |
| F16 | 1220-1334 | 11.0 | 80 | 8.3 | None - | - | - | - | - |
| F16A | 1334-1503 | 11.0 | 70 | 9.4 | None - | - | - | - | - |
| F17 | 1503-1630 | 12.3 | 86 | 8.6 | One - medium | 55-82 | 82 | 0.1 | Herring |
| | | | | | One - light | 70-91 | 91 | 0.3 | Groundfish |
| F18 | 1603-1715 | 6.0 | 44 | 8.2 | One - medium | 137-155 | 155-165 | 0.4 | Groundfish |
| | | | | | One - medium | 128-146 | 155 | 0.1 | Groundfish |
| F19 | 1715-1913 | 18.1 | 121 | 9.0 | None - | - | - | - | - |
| S.W. Bonilla Is. | | | | | | | | | |
| F20 | 1913-2014 | 8.8 | 58 | 9.1 | None - | - | - | - | - |
| F21 | 2014-2108 | 7.7 | 53 | 8.7 | None - | - | - | - | - |
| F22 | 2108-2201 | 7.7 | 53 | 8.7 | One - heavy | 91-110 | 110 | 0.2 | Herring |
| F23 | 2201-2255 | 7.7 | 51 | 9.1 | None - | - | - | - | - |
| F24 | 2255-2347 | 7.9 | 54 | 8.8 | None - | - | - | - | - |
| | 30/01/85 | | | | | | | | |
| F25 | 2347-0038 | 7.8 | 52 | 9.0 | None - | - | - | - | - |
| F26 | 0038-0133 | 7.8 | 53 | 8.8 | None - | - | - | - | - |
| F27 | 0133-0222 | 7.3 | 49 | 8.9 | None - | - | - | - | - |
| F28 | 0222-0311 | 6.8 | 47 | 8.7 | Two - medium | 78-86 | 91 | 0.3 | Groundfish |
| F29 | 0311-0350 | 5.4 | 40 | 8.1 | None - | - | - | - | - |
| F30 | 0350-0429 | 4.9 | 39 | 7.5 | None - | - | - | - | - |
| F31 | 0429-0506 | 5.5 | 37 | 8.9 | None - | - | - | - | - |
| F32 | 0506-0545 | 5.2 | 39 | 8.0 | None - | - | - | - | - |
| F33 | 0545-0629 | 5.4 | 41 | 7.9 | None - | - | - | - | - |
| F34 | 0629-0700 | 4.0 | 30 | 8.0 | None - | - | - | - | - |
| S.W. Bonilla Is. | | | | | | | | | |
| G1 | 0859-0910 | 2.0 | 11 | 10.9 | Several - light | 155-174 | 155-174 | 0.7 | Groundfish |
| G2 | 0910-0922 | 2.1 | 12 | 10.5 | None - | - | - | - | - |
| G3 | 0922-0942 | 3.4 | 20 | 10.2 | None - | - | - | - | - |
| G4 | 0942-1009 | 3.6 | 27 | 8.0 | None - | - | - | - | - |
| G5 | 1009-1020 | 2.0 | 11 | 10.9 | None - | - | - | - | - |
| G6 | 1020-1040 | 3.2 | 20 | 9.6 | None - | - | - | - | - |
| G7 | 1040-1100 | 3.5 | 17 | 12.3 | Several - light | 128-146 | 146-165 | 1.2 | Groundfish |

Table 7. Maturity stages for Pacific herring sampled at the Pacific Biological Station. The descriptions of each stage are adapted from criteria developed for Atlantic herring (Bowers and Holliday 1961; Parrish and Saville 1965) and modified to suit the unique characteristics of Pacific herring which are exclusively winter-spring spawners.

| Stage | Maturity | Gonad appearance | Description | Timing |
|---|---|---|---|---|
| I | Undeveloped | Thread-shaped | Virgin herring with small gonads, less than 2 mm broad. Accurate macroscopic determination of sex no usually possible. | Year-round for young herring, usually less than 150 mm in standard length. |
| II | Starting | Ribbon-shaped | Gonads increased in breadth to 3-5 mm. Sex determination possible. Testes reddish-grey coloured and knife-shaped; ovaries reddish-wine coloured and rounder. (The gonads of virgins and some repeat spawners cannot be distinguished mascrocopically.) | Late spring and early summer. |
| III | Developing | Tube-like | Gonads thickened, increased in breadth (5-15 mm) and elongated, but not extending full length of body cavity. Ovaries red to reddish-orange with granular appearance; testes reddish-grey with smooth texture. | Late summer and early fall. |
| IV | Maturing | Prominent | Gonads extend full length of body cavity. Ovaries reddish-orange to yellow; eggs distinguishable, opaque, variable in size and separable. Testes mostly grey; and will ooze sperm if sliced with a knife. Blood vessels clearly visible in the ovary and testes wall. | Late fall and early winter. |

Table 7 (cont'd)

| Stage | Maturity | Gonad appearance | Description | Timing |
|---|---|---|---|---|
| V | Mature | Bulging | No blood vessels visible in gonad walls. Ovaries gold-yellow; eggs mostly transparent and uniform in size. Eggs can be exuded from the ovary under pressure and are adhesive on contact. Testes milk-white; sperm will flow under pressure. | Early winter for males, late winter for females. |
| VI | Ripe | Running | Eggs transparent. Eggs and sperm flow easily without external pressure. | A few days prior to spawning (usually in late winter or early spring). |
| VII | Spent | Baggy | Gonads slack. Ovaries may contain a few residual eggs. Testes limp and bloodshot. | Early spring for the first few weeks following spawning |
| VIII | Recovering | Compressed | Gonads wine-coloured and usually longer and thicker than in Stage II. Blood vessels prominent. (This stage passes into Stage III, but may resemble Stage II in the process.) | Late spring and early summer. |

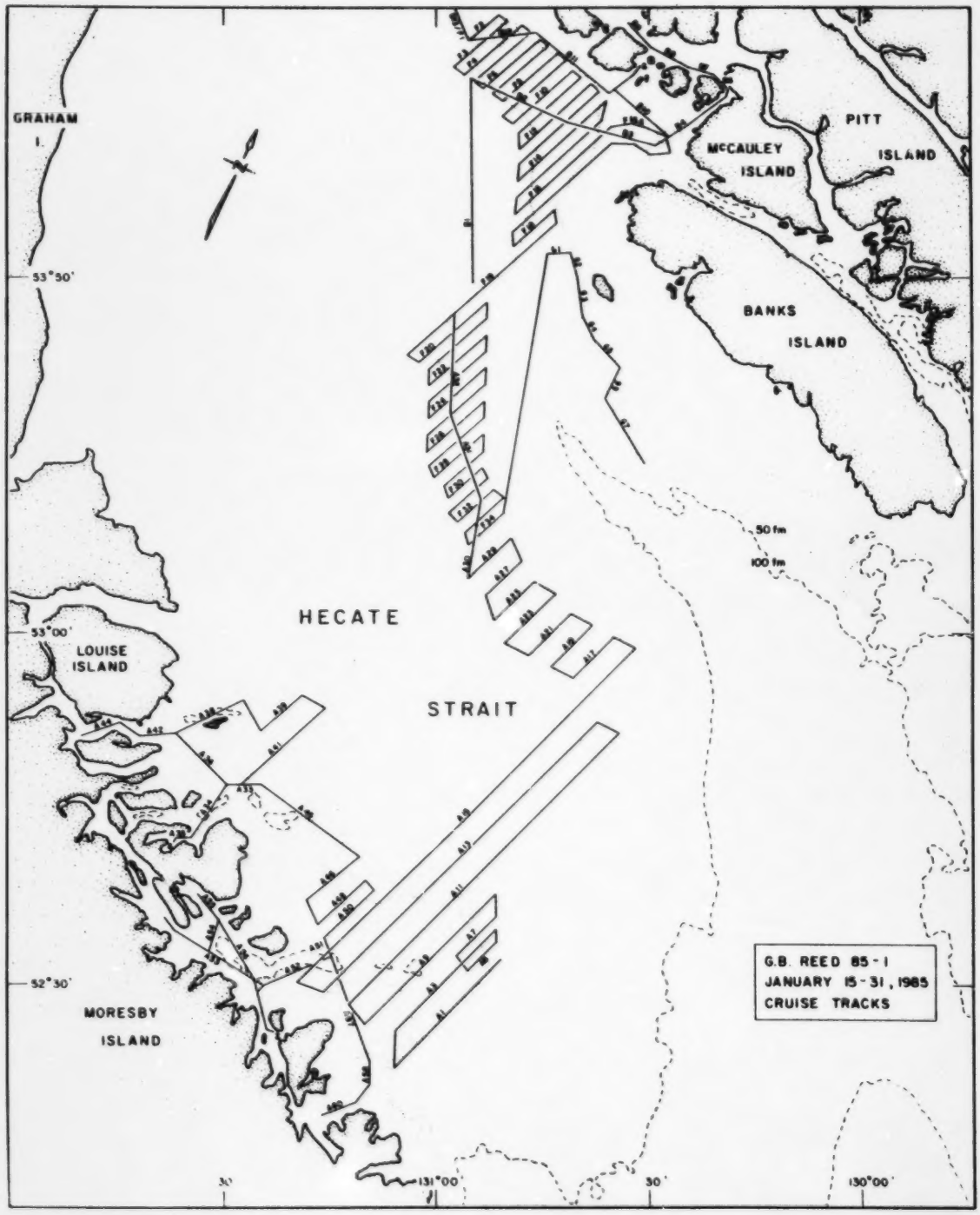
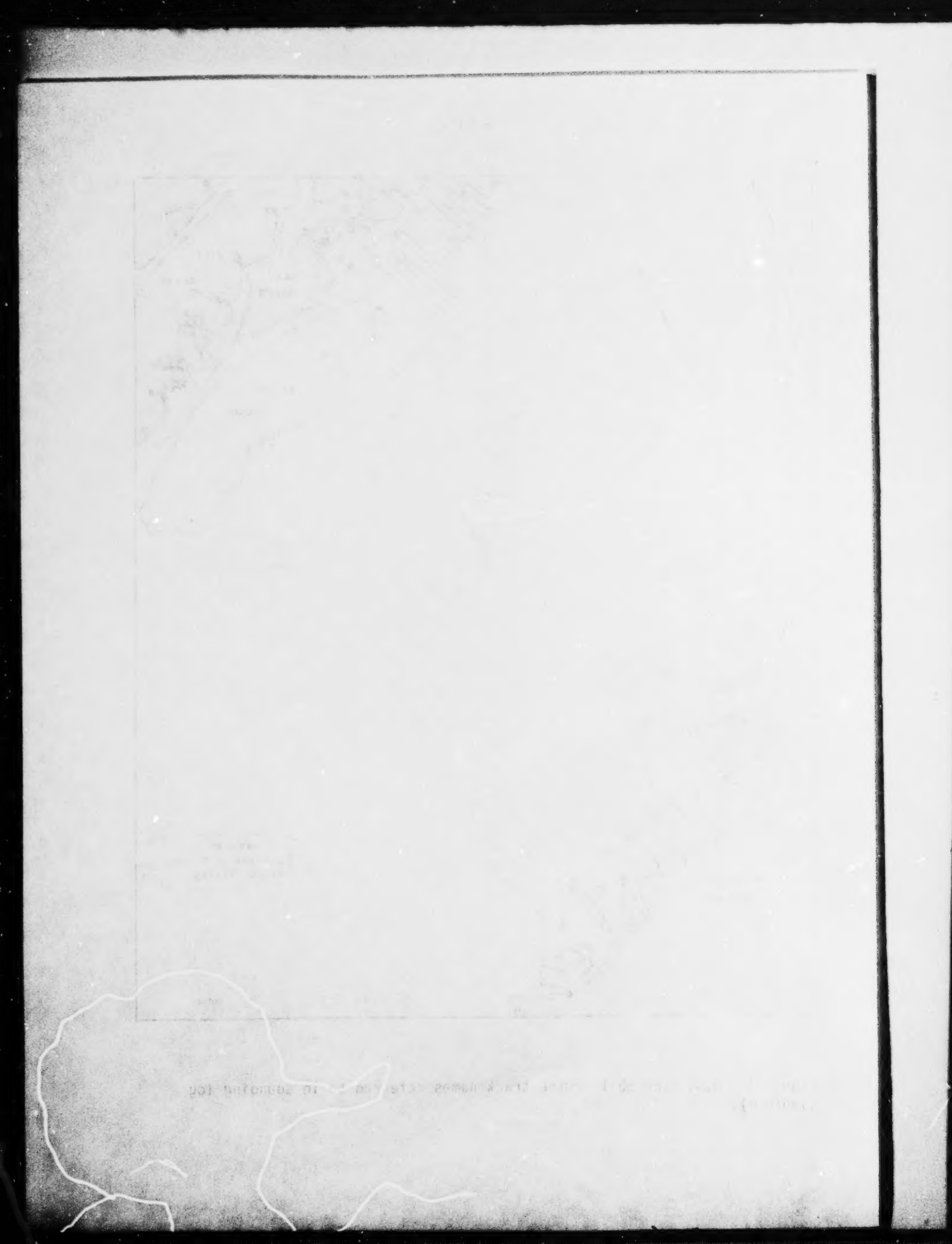



Figure 1. G.B. REED 85-1 cruise track names referred to in sounding log (Table 6).



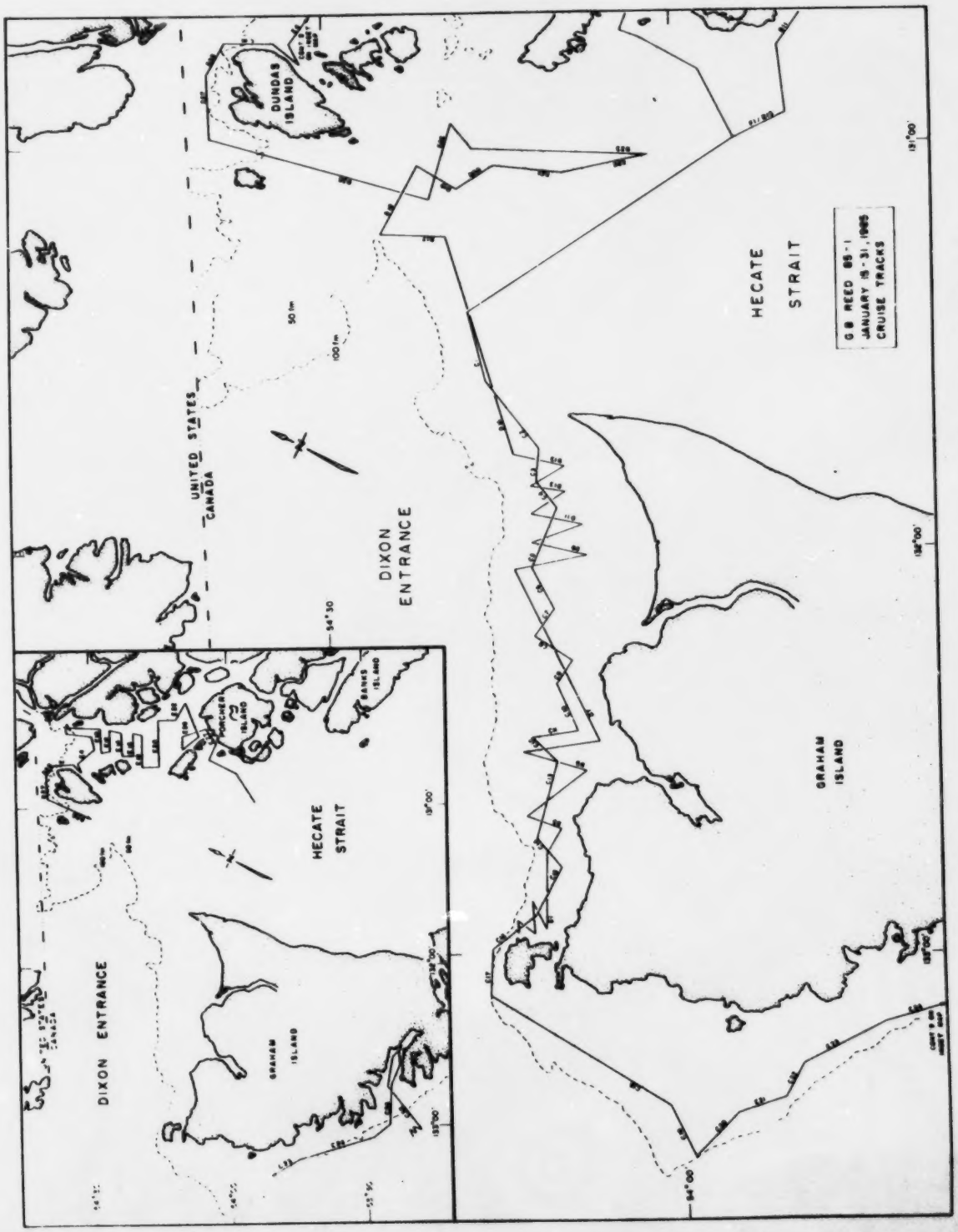



Figure 2. G.B. REED 85-1 cruise track names referred to in sounding log (Table 6).

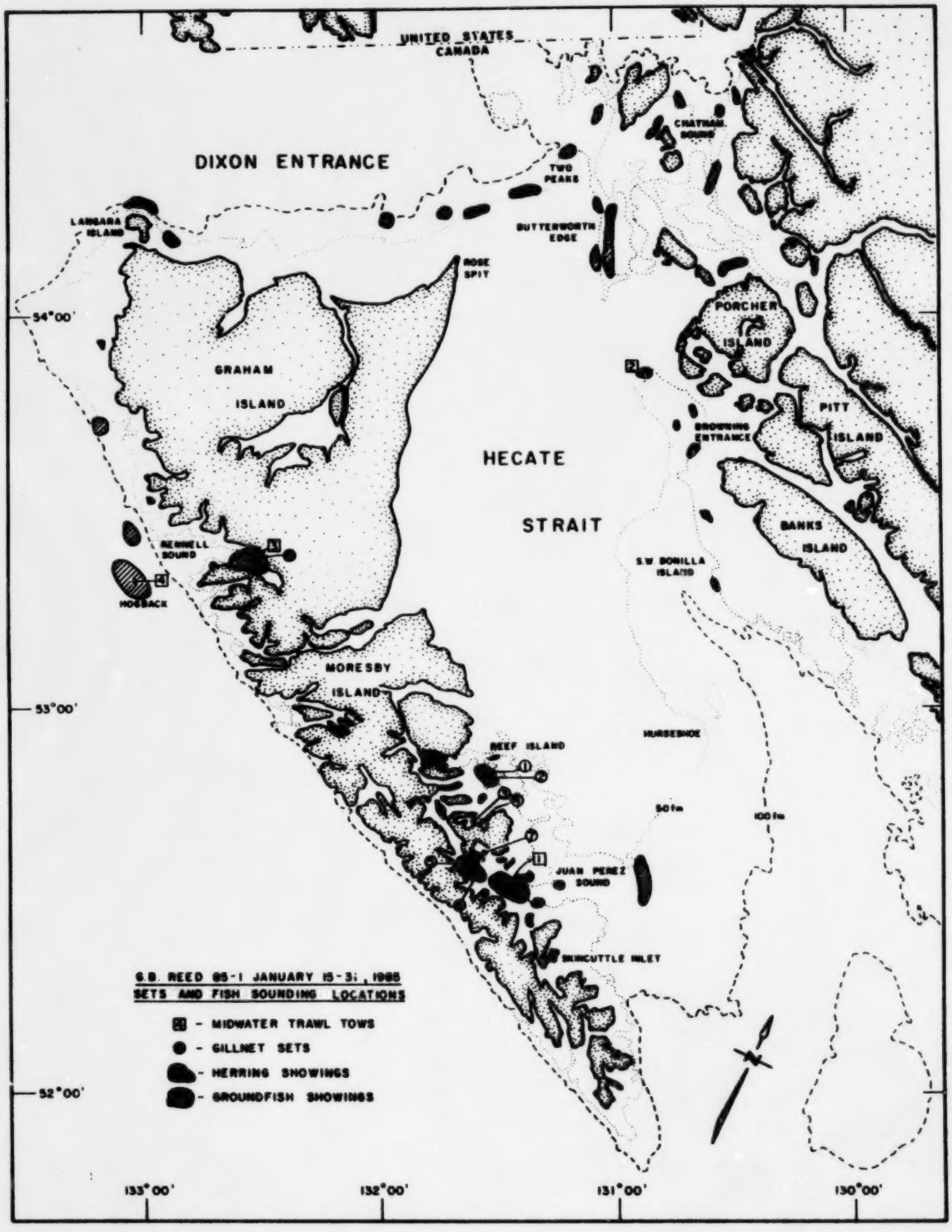



Figure 3. Locations of sets and fish sounding areas of G.B. REED cruise 85-1, January 15-31, 1985.

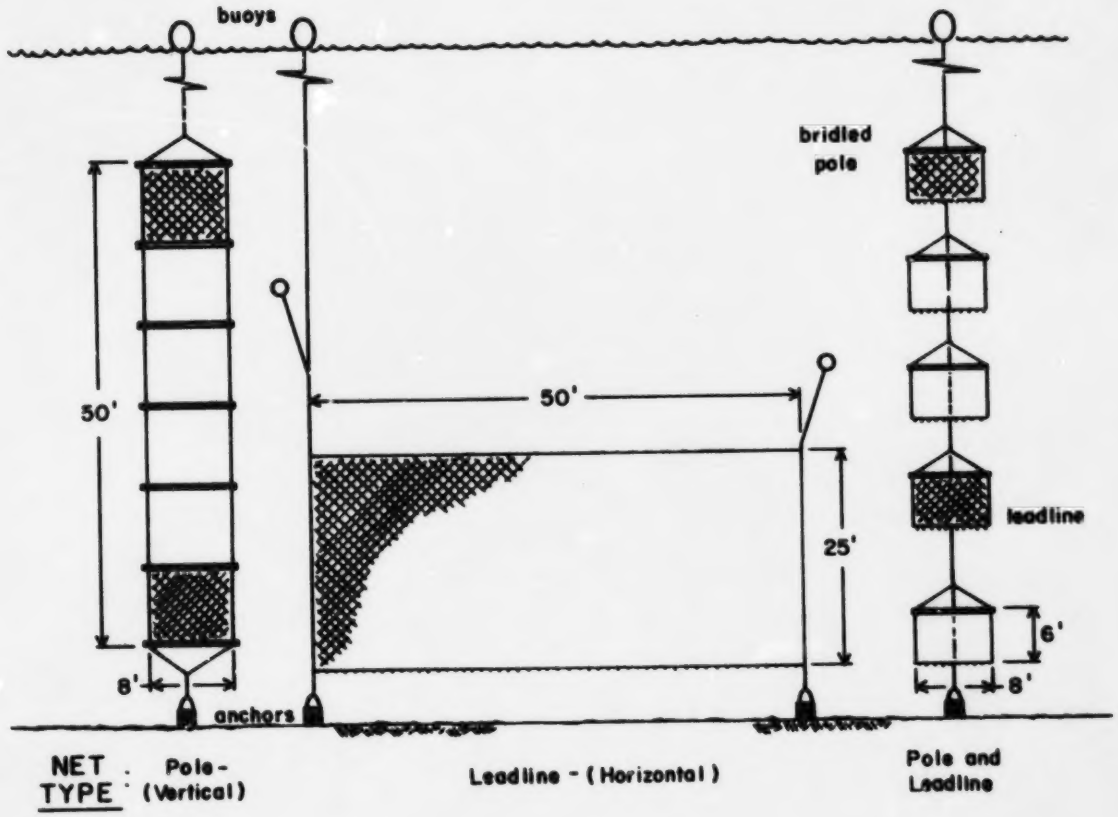



Figure 4. Gillnets used on G.B. REED cruise 85-1, January 15-31, 1985.

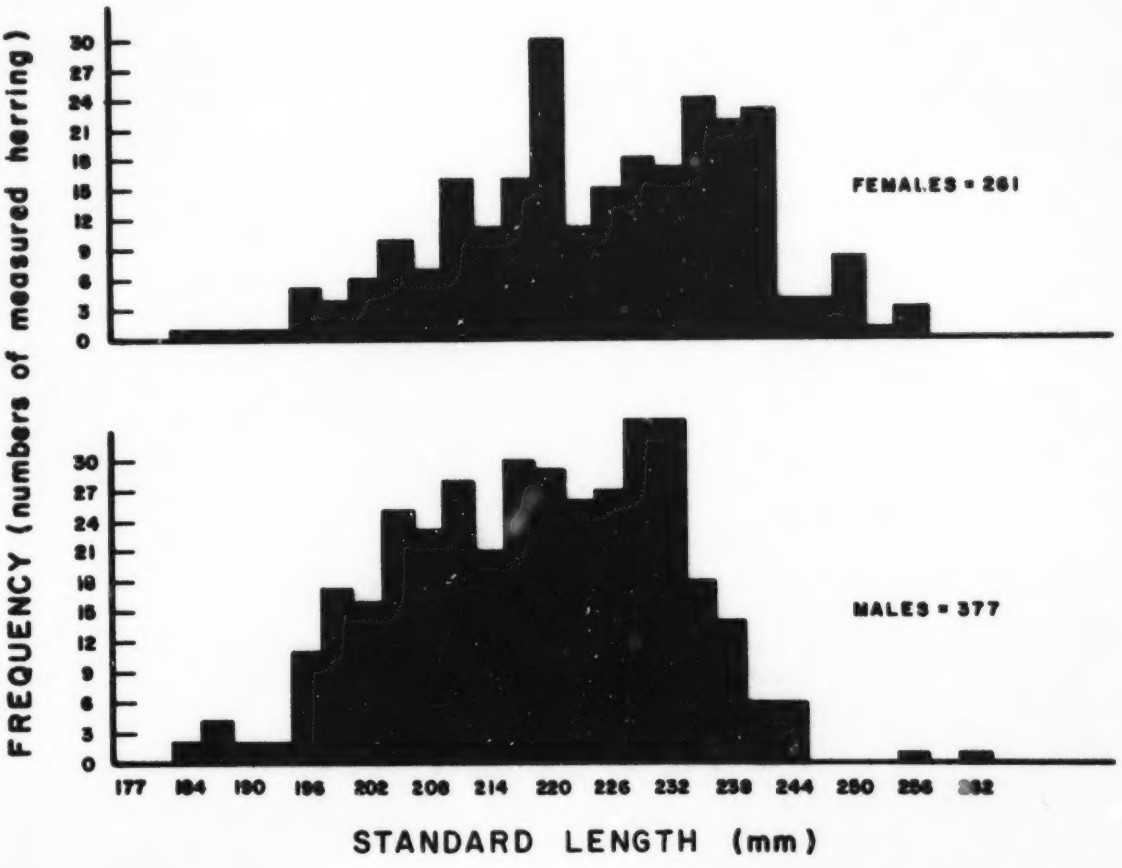



Figure 5. Length frequency histogram of Juan Perez herring caught January 22, 1985.

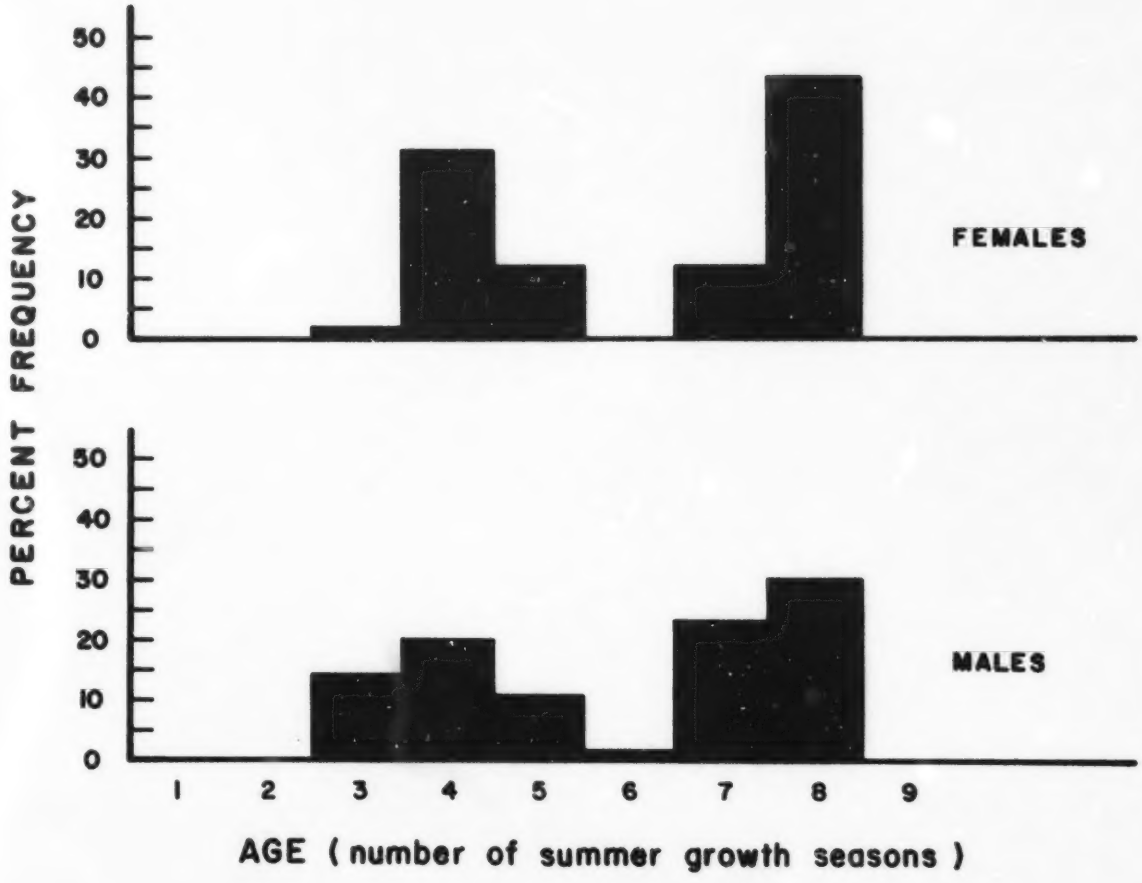



Figure 6. Age frequency histogram of Juan Perez herring caught January 22, 1985.

Figure 7. Juan Perez Sound 1400-1500 hours. Broken, midwater herring schools at 75-85 fathoms. Simrad EK38 Gain setting 2.

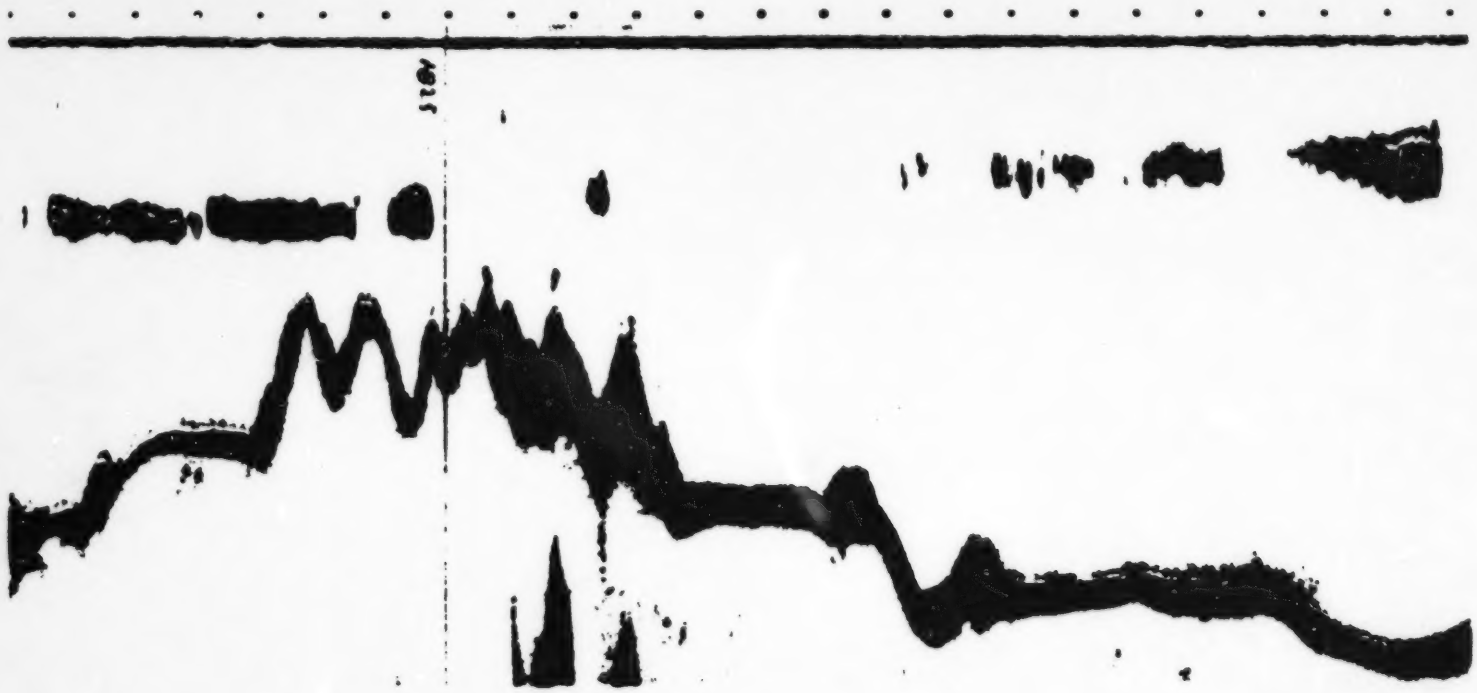


Figure 8. Juan Perez Sound 1800-1900 hours. Assembled, midwater herring schools at 31-41 fathoms. Simrad EK38 Gain setting 2.

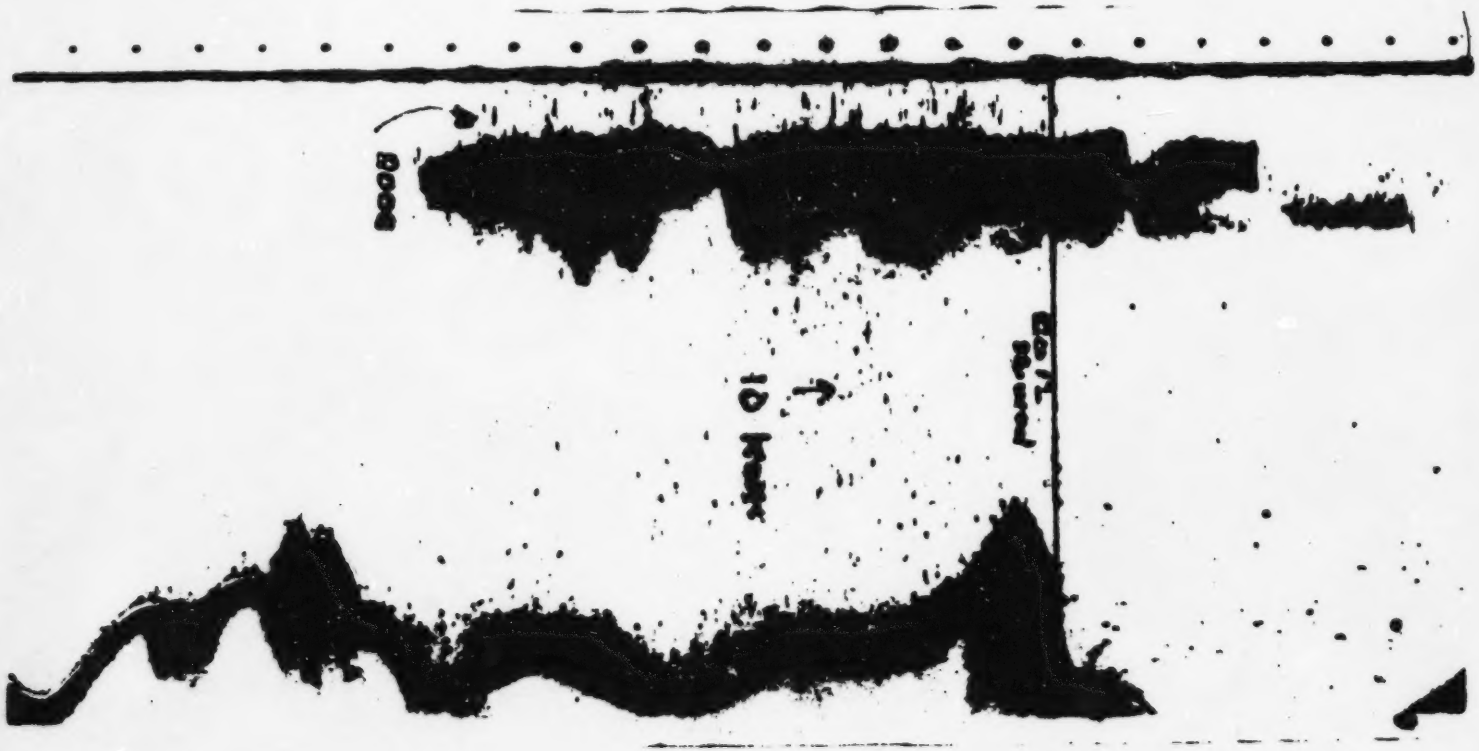


Figure 9. Juan Perez Sound 1900-2000 hours. Subsurface, herring skimmer at 12-35 fathoms. Simrad EK38 Gain setting 2.